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ECONOMIC INTELLIGENCE REPORT

PRODUCTION OF SYNTHETIC ALCOHOL IN THE USSR

CIA/RR 99
30 August 1957

CENTRAL INTELLIGENCE AGENCY

OFFICE OF RESEARCH AND REPORTS

~~CONFIDENTIAL~~

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(ORR Project 22.1728)

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PRODUCTION OF SYNTHETIC ALCOHOL IN THE USSR*

Summary

The Sixth Five Year Plan (1956-60) of the USSR calls for a sharp increase in the production of ethyl alcohol from petroleum gas to about 200 million gallons in 1960. This program is significant because it represents one way in which the food supply of the USSR could be substantially increased. In 1955, 2 million tons of grain, 1.9 million tons of potatoes, and 740,000 tons of molasses were consumed in the production of ethyl alcohol. About one-half of the total volume of ethyl alcohol produced from these food materials was required for industrial purposes.

The production of synthetic alcohol is estimated to have been only 15 million gallons in 1955, or less than 5 percent of the officially reported production of all types of alcohol, 338 million gallons. It is estimated that 282 million gallons of ethyl alcohol were produced by the fermentation of food materials, and 41 million gallons from wood and wood byproducts.

It is estimated that production of synthetic alcohol in 1960 will not exceed 150 million gallons. The goal of 200 million gallons probably will not be fulfilled because the factors which resulted in gross underfulfillment of the Fifth Five Year Plan (1951-55) for synthetic alcohol are still seriously hampering the program. These factors include a lagging program for construction as well as technological and organizational problems.

Large-scale production of synthetic alcohol is an important part of the drive to eliminate completely the consumption of food materials in the production of industrial alcohol by 1960. The estimated production of synthetic alcohol and ethyl alcohol derived from wood in 1960, coupled with tentative estimates of industrial requirements for alcohol in 1960, however, raise serious doubts about achievement of this goal. The estimates indicate that the requirements for food materials to produce industrial alcohol in 1960 will be reduced at

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 15 June 1957.

most by only 25 percent from the level of 1955. In terms of grain, this reduction would represent a saving of approximately 400,000 metric tons.*

I. Introduction.

Ethyl alcohol,** an important industrial chemical, can be synthesized from petroleum gas*** at approximately one-half the cost of producing alcohol from fermented food materials, the traditional source. In fact, Soviet statments indicate that the cost of synthetic alcohol is only 40 percent of the cost of fermentation alcohol. 1/**** In the US, synthetic alcohol was first produced in the 1930's and, because of its lower cost, has gradually replaced fermentation alcohol. In 1955 the synthetic process accounted for four-fifths of the production of alcohol in the US. 2/ The USSR produces only limited quantities of synthetic and wood-derived ethyl alcohol, and the very substantial requirements of industry for this product are met primarily by distilling fermented food materials (grain, potatoes, and molasses). The Soviet chemical industry, however, is committed to an ambitious program to expand the production of synthetic alcohol under the Sixth Five Year Plan./

Developments in the production of synthetic alcohol in the USSR have dual significance. In the first place, these developments represent the first major effort of the Soviet chemical industry to manufacture petrochemicals// and thus provide a measure of the

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* Tonnages are given in metric tons throughout this report.

** As used in this report, the word alcohol means ethyl alcohol.

*** Synthetic alcohol is derived from ethylene gas. A major source of ethylene is the gas given off with the thermal and catalytic cracking of petroleum. Ethylene can also be obtained from natural gas, the cracking and pyrolysis of heavy petroleum fractions, and certain other sources.

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/ The possibility that downward revisions will be made in the goals for the production of synthetic alcohol and chemical end products under the Sixth Five Year Plan has not been considered in this report.

// The word petrochemical has been defined as "any chemical recovered or derived from petroleum or natural gas and intended for chemical markets." 3/ This definition includes basic or intermediate chemicals but excludes finished products such as plastics, synthetic rubber, and synthetic fibers. In addition to synthetic alcohol, many other chemicals

capabilities of the industry in this field. Secondly, and of more direct and immediate significance, the production of alcohol from petroleum rather than from agricultural materials releases supplies of food for other uses. The elimination of food materials from the production of industrial alcohol -- an announced Soviet objective -- would increase substantially the supply of grain available for direct consumption.

II. Fifth Five Year Plan (1951-55).

A. Plans and Achievements.

Soviet efforts to produce synthetic alcohol date back at least to 1948, but they have been given little publicity in the press until recently. The draft directives for the Fifth Five Year Plan said practically nothing about synthetic alcohol. A recent article indicates, however, that the previously unannounced goals for the production of synthetic alcohol under the Plan were very ambitious. 5/ The Fifth Five Year Plan reportedly called for the installation of sufficient capacity by 1955 so that the production of industrial alcohol from food materials would be largely eliminated. This Plan was grossly underfulfilled, however. It is estimated that 221 million gallons of alcohol were produced from grain and potatoes in 1955, whereas only 15 million gallons were produced synthetically. Although construction at several plant sites was reportedly begun as early as 1949, 6/ only one synthetic alcohol plant, at Sumgait, was in actual operation by the end of 1955. Recent information indicates that five other plants were under construction by 1955. Two of these plants were completed in 1956, and the other three evidently are scheduled for completion in 1957.

B. Problems.

Apparently the main reason for the failure to meet the goals for the production of synthetic alcohol under the Fifth Five Year Plan was simply that the Ministry of the Chemical Industry, which is apparently responsible for the construction of synthetic alcohol plants, did not put sufficient effort behind the program for construction. In one of several statements on the subject that have appeared in the press, the Director of the Groznyy Plant, which is still under construction, blamed the ministry for the delay in completion of his plant.

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are now obtained from this source in the US. The value of petrochemicals produced in the US in 1956 is estimated to have been in excess of US $3 billion. 4/

> The Ministry of the Chemical Industry in the past Five Year Plan created in Groznyy a special construction organization. /The construction organization/ could have had a group of shops for the production of alcohol in operation this year if the Ministry had paid more attention to us. However, the material-technical supply of construction is going poorly. As a result, in spite of the government directives, the volume of completed work is not increasing but is being decreased. Last year, /1955/, in relation to 1953, it amounted to only about 70 percent. 7/

A more general statement to the same effect was contained in a Soviet periodical.

> ... the management of the Ministry of the Chemical Industry ... /is/ not paying sufficient attention to capital construction, which was the chief reason for the nonfulfillment of the /synthetic/ alcohol production plan and the activation of new capacity in the Fifth Five Year Plan. 8/

Finally, at the 20th Congress of the Party in February 1956, the ministry was bluntly accused of neglecting the program for the production of synthetic alcohol and petrochemicals in general. Discussing the lag in petrochemicals, Pervukhin, Deputy Chairman of the Council of Ministers, stated: "The chief responsibility in this matter belongs to the Ministry of the Chemical Industry, which has paid little attention to the development of this important branch of the national economy." 9/

In addition to the lag in construction, certain technological problems apparently have hampered the program. Specific inadequacies have been reported in the design and production of the equipment -- such as compressors, pumps, and refrigerating units -- required to convert ethylene to alcohol. 10/ Another problem, the difficulty in developing a standard design for plants, may have been complicated by the Soviet choice between alternative processes for the production of synthetic alcohol. There are two processes now used to synthesize alcohol from petroleum gases. In the standard process, which has been in commercial use in the US for more than 20 years, ethylene is absorbed in sulfuric acid to produce ethyl sulfate, which is then hydrolyzed to produce alcohol. The second, and newer, process involves the

direct hydration of ethylene gas to alcohol without the intermediate production of ethyl sulfate. The newer process has the advantage of not requiring the input of highly concentrated sulfuric acid and the subsequent reconcentration of dilute acid for recycling. The process of direct hydration, which was first used in 1948, has been installed to date in only 4 plants outside the USSR: 2 in the US, 1 in the UK, and 1 in Germany. 11/ Only one-sixth of US synthetic alcohol was produced by the direct process in 1955. 12/ The first synthetic alcohol plant to operate in the USSR apparently employs the standard ethyl sulfate process, but the direct process was installed at both of the plants which reportedly were completed in 1956. Soviet texts have given considerable emphasis to the fact that sulfuric acid is not required in the direct process, 13/ and Soviet preference for this method, which requires high-pressure equipment, may have been a contributing factor in delaying the program.*

The fact that the production of synthetic alcohol involves both the Ministry of the Chemical Industry and the Ministry of the Petroleum Industry has compounded the technological problem. Many reports testify to the fact that the Ministry of the Petroleum Industry, adopting the parochial view characteristic of Soviet industrial ministries, has not been at all cooperative in the production of petrochemicals. 15/ To obtain sufficient quantities of the petroleum gases required for the production of alcohol, refinery operations must be geared to the requirements for processing chemicals. This coordination obviously necessitates a certain amount of long-range joint planning of petroleum refining and chemical processing operations. The statement made in February 1956 that the production of the synthetic alcohol plant at Sumgait has been hampered by a chronic shortage of gases from the refinery at Novo Bakinskiy reflects the seriousness of the problem. 16/ It is not yet clear whether recent proposals by Khrushchev to decentralize the Soviet economy 17/ will provide any solution to the organizational problem in the production of petrochemicals.

C. Supply.

Although the Ministry of the Chemical Industry was producing only a small quantity of synthetic alcohol by the end of 1955, total

* One recent Soviet article implies that the process of direct hydration has no advantage in terms of cost over the process employing ethyl sulfate. 14/

production of alcohol increased steadily. The production of alcohol in the USSR in 1946-55 is shown in Table 1. It was reported that production increased from 193 million gallons in 1950 to 338 million gallons in 1955, a gain of 75 percent.

Table 1

Production of Ethyl Alcohol in the USSR a/
1946-55

Year	Amount b/ (Million Gallons)	Index (1950 = 100)
1946	89	46
1947	96	50
1948	145	75
1949	182	94
1950	193	100
1951	214	111
1952	235	122
1953	279	145
1954	303	157
1955	338	175

a. 18/
b. Eighty-eight percent ethyl alcohol by volume.

The estimated production of alcohol in the USSR, by type of raw material, in 1946-55 is shown in Table 2.* In 1955 the production of synthetic alcohol amounted to only about 15 million gallons, or less than 5 percent of total production. In order to meet the steadily increasing requirements for alcohol in the manufacture of synthetic rubber, as well as to provide a sharp increase in the availability of alcoholic beverages, the production of alcohol by fermentation from edible sources in 1955 was increased by 60 percent over that in 1950.**

* Table 2 follows on p. 7.
** Plants producing alcohol from edible sources are subordinate to the Ministry of the Food Industry.

Table 2

Estimated Production of Ethyl Alcohol in the USSR, by Type of Raw Material a/
1946-55

Million Gallons

	Edible Materials				Inedible Materials			
Year	Grain	Potatoes	Molasses	Total	Wood	Petroleum	Total	Total from All Sources
1946	N.A.	N.A.	N.A.	86	3	0	3	89
1947	N.A.	N.A.	N.A.	91	5	0	5	96
1948	N.A.	N.A.	N.A.	136	9	0	9	145
1949	57	76	35	168	14	0	14	182
1950	60	67	49	176	17	0	17	193
1951	81	48	63	192	N.A.	Unknown	22	214
1952	95	46	66	207	N.A.	N.A.	28	235
1953	125	46	70	241	N.A.	N.A.	38	279
1954	136	49	73	258	37	8	45	303
1955	164	57	61	282	41 b/	15	56	338

a. For methodology, see Appendix A.
b. Production by hydrolysis in 1955 was reported as 22 million gallons. 19/

In 1955, fermentation plants accounted for more than 83 percent of total production. Although the production of alcohol from wood* increased sharply between 1951 and 1955, it accounted for only about 12 percent of the total by 1955.

The estimated consumption of edible raw materials in the production of alcohol in the USSR in 1949-55 is shown in Table 3. The increase in the production of alcohol by fermentation necessitated a sharp increase in the requirements for grain. Inputs of grain more than doubled between 1950 and 1955, offsetting not only failures in the production of synthetic alcohol but also decreases in the deliveries of potatoes.**

Table 3

Estimated Consumption of Edible Materials
in the Production of Ethyl Alcohol in the USSR a/
1949-55

Million Tons

Year	Grain	Potatoes	Molasses
1949	0.7	2.6	0.5
1950	0.8	2.3	0.6
1951	1.0	1.7	0.7
1952	1.2	1.6	0.8
1953	1.6	1.6	0.9
1954	1.7	1.7	0.9
1955	2.0	1.9	0.7

a. For methodology, see Appendix A.

* There are two processes used in the USSR for obtaining ethyl alcohol from wood (not to be confused with methyl or wood alcohol). The first process is the hydrolysis of wood in the form of chips, shavings, or sawdust. The second process is the fermentation of sugars contained in the spent liquid from the manufacture of sulfite woodpulp. Plants producing ethyl alcohol from wood are subordinate to the Ministry of the Paper and Wood Processing Industry.

** The decreased use of potatoes in the production of alcohol in 1951-53 reportedly was the result of poor potato crops. 20/

D. Use Patterns.

Use patterns for alcohol in the USSR in 1950 and 1955 are shown in Table 4. It is estimated that three-fifths of the alcohol produced under the Fifth Five Year Plan was channeled to industrial uses, largely for the manufacture of synthetic rubber. Industrial requirements apparently absorbed 143 million gallons* of the 282 million gallons produced from edible sources in 1955, an increase of 42 percent over the 101 million gallons of such alcohol so consumed in 1950.

Table 4

Estimated Use Patterns of Ethyl Alcohol in the USSR a/
1950 and 1955

	Million Gallons	
Use	1950	1955
Beverage Industry	75	139
Synthetic rubber	95	159
Other	23	40
Total industry	118	199
Grand total	193	338

a. For methodology, see Appendix A.

III. Sixth Five Year Plan (1956-60).

A. Goals.

The draft directives of the 20th Party Congress of the USSR for the Sixth Five Year Plan, which were published in January 1956, called for a tenfold increase in the production of synthetic alcohol.

* Total industrial requirements less production from inedible sources.

The revised directives of February 1956 contained no reference to goals for the production of alcohol in 1960 but called for a complete elimination of the industrial use of food materials. Recent statements in the press indicate that the original goal for alcohol was subsequently revised upward and that the revised goal for 1960 is about 200 million gallons.*

B. Prospects for Plan Fulfillment.

The production of synthetic alcohol in the USSR through 1957 can be predicted with some degree of precision. Production at the Sumgait plant (the first such plant to be put into production) reached an estimated level of 19 million gallons in 1956, an increase of about 30 percent over production in 1955.** The completion of two new plants, one at Ufa and the other at Orsk, was reported late in the year.

In 1957, Soviet production of synthetic alcohol is scheduled to increase by 91 percent over that in 1956, 21/ reaching about 36 million gallons. It is estimated that 20 to 25 million gallons will be produced at the plant at Sumgait in 1957 and a few million gallons at each of the new plants at Ufa and Orsk. The Plan for 1957 also calls for the completion of the first sections of three plants, presumably those at Saratov, Groznyy, and Novo Kuybyshevsk. The combined capacity of the 6 plants tentatively is estimated at 134 to 182 million gallons. Such a figure may have represented the original goal for 1955, inasmuch as construction of all these plants was begun under the Fifth Five Year Plan or earlier. Moreover, the elimination of food materials in the production of alcohol, as called for in the Fifth Five Year Plan, would have required the production of about 158 million gallons of synthetic alcohol in 1955.***

The construction of two new plants at Omsk and Lisichansk was begun in 1956, the first year of the Sixth Five Year Plan. The

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* For methodology, see Appendix A.

** For details concerning synthetic alcohol plants in the USSR, see Appendix A.

*** See Table 5, p. 12, below. The total production of industrial alcohol in 1955 was 199 million gallons. Because only 41 million gallons were produced from wood, the complete elimination of food materials in the production of alcohol would have required the production of 158 million gallons of synthetic alcohol.

plant at Omsk is scheduled to be in operation by the end of 1960, and the plant at Lisichansk probably is scheduled for completion at that time. A synthetic alcohol shop is also planned for the petroleum refinery under construction at Ryazan. A second and very large plant near Sumgait apparently was originally scheduled for completion in 1960. Inasmuch as this plant was not included in the 1957 Plan for Azerbaydzhan SSR, construction will not begin before 1958.

It can be assumed that the plants at Sumgait, Ufa, Orsk, Saratov, Groznyy, and Novo Kuybyshevsk all will be in operation by 1960.* It is doubtful whether those plants which had not been constructed by the end of 1955 will contribute significantly to the production of synthetic alcohol by 1960. Despite the severe criticism leveled at the Ministry of the Chemical Industry for its failures under the Fifth Five Year Plan, the goal for construction in the first 9 months of 1956 was fulfilled by only 71 percent. 22/ It is not at all certain, however, that the operating plants will be producing at or near full capacity by 1960. The plant at Sumgait, for example, was in operation by 1952, but production did not approach full capacity until 1956, probably because of an inadequate supply of process gas. Shortages of equipment may also prevent production at full capacity. On balance, it seems probable that production of synthetic alcohol in 1960 will not exceed 150 million gallons.

C. Requirements.

As previously noted, the revised Party directives of February 1956 call for the complete elimination of the industrial consumption of food products in the USSR by the end of 1960. On the basis of the information now available on the requirements for industrial alcohol and on the production of alcohol from inedible sources by 1960, it appears that this goal will not be fulfilled.

It is tentatively estimated that the requirements of Soviet industry for alcohol in 1960 will increase at least 75 percent over those in 1955. Production of synthetic rubber, which consumed most of the industrial alcohol produced in 1955, is scheduled for an increase of 120 percent by 1960. A small part of the increase, perhaps as much as 10 percent, probably will be achieved by the production

* It is possible but not probable that there are other plants in advanced stages of construction which have not been mentioned in the press.

of oil-extended rubber, that is, by adding oil to the basic synthetic material. Another small part of the increase will be produced directly from butane, thus eliminating the need for alcohol, but no synthetic rubber plants based on this raw material are known to be in operation as yet. The first plant to produce synthetic rubber from butane is scheduled for completion in 1957. 23/ Industrial requirements for the manufacture of products other than rubber also should increase substantially. Total production of plants subordinate to the Ministry of the Chemical Industry is scheduled to be doubled. The organic chemicals sector of the industry, which requires alcohol for the production of acetaldehyde, acetic acid, ethyl chloride, and other chemicals, has been growing at a more rapid rate than other sectors.

Assuming an increase of 75 percent in both the consumption and the production of industrial alcohol in the USSR under the Sixth Five Year Plan, production will increase from about 199 million gallons in 1955 to about 348 million gallons in 1960. On this basis, production by type of raw material in 1955 and 1960 has been estimated and is shown in Table 5. Production from wood probably will amount to

Table 5

Estimated Production of Industrial Ethyl Alcohol in the USSR
by Type of Raw Material
1955 and 1960

Million Gallons

Source	1955 a/	1960
Inedible materials	56	240
Edible materials	143	108
Total	199	348

a. For methodology, see Appendix A.

approximately 90 million gallons by 1960.* This amount, added to the estimate of 150 million gallons of synthetic alcohol, indicates that

* The goal of the Sixth Five Year Plan, which is estimated at 99 million gallons on the basis of a scheduled increase of 130 percent, 24/

a maximum of 240 million gallons should be produced from inedible materials. Therefore, at least 108 million gallons must be produced from edible materials, a saving of not more than 25 percent from the level of 1955. In terms of grain, the saving would amount to approximately 400,000 tons.

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probably will not be achieved. The plan for the construction of hydrolysis plants during the first 9 months of 1956 was fulfilled by only 77 percent. 25/

APPENDIX A

METHODOLOGY

1. Estimates of Production of Alcohol, by Type of Raw Material.*

Soviet officials have released statistics on the production of alcohol in every year since World War II and on the yields of alcohol per ton of grain, potatoes, and molasses in 1950-55. 26/ Estimates of production, by type of raw material, in 1949-55 were derived from these data, coupled with statements in the Soviet press concerning (a) the quantities of grain, potatoes, and molasses consumed in the production of alcohol in 1951 and 1955; (b) the percent of alcohol produced from edible sources in 1946, 1950, and 1955; (c) the percentage of alcohol from edible sources produced from grain, from potatoes, and from molasses in 1949, 1950, 1951, and 1953; and (d) the percent of alcohol from inedible sources produced synthetically from petroleum in 1955.

2. Use Patterns for Alcohol, 1950 and 1955.**

The production of alcohol for beverages in the USSR was estimated from officially released statistics on the production of vodka and vodka products. 27/ Conversion was made on the basis of 10 gallons of vodka and vodka products to 4.5 gallons of 88 percent alcohol. Estimates of production of the industrial alcohol were then obtained by subtraction.

The production of synthetic rubber in the USSR reportedly consumed the equivalent of "up to" 2 million tons of grain in 1955. 28/ Another report stated that more than one-half of all alcohol produced went into the production of synthetic rubber. 29/ Two million tons of grain would yield 159 million gallons of alcohol (assuming a yield of 30 decaliters, or 79.3 gallons per ton), which would represent 47 percent of the total production of alcohol in 1955. A figure for other industrial uses was obtained by subtraction. Requirements for synthetic rubber in 1950 were estimated on the basis of the percentage increase in the production of synthetic rubber under the Fifth Five Year Plan.

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* See Table 2, p. 7, above.
** See Table 4, p. 9, above.

3. Estimate of the 1960 Plan.*

The draft directives for the Sixth Five Year Plan did not give the goal for the production of synthetic alcohol in absolute terms but called for an increase of approximately 10 times, as well as the elimination, "on the whole," of the use of food products for industrial purposes. 30/ The revised directives, published in February 1956, contained no specific mention of goals for the production of alcohol but called for the complete elimination of the use of food products for industrial purposes. 31/ No official announcements regarding goals for the production of synthetic alcohol in 1960 have been released since that time.

Planned increases and certain other bits of information have, however, been included in articles in the Soviet press. It was stated in October 1956 that the production of synthetic alcohol will be increased "more than" 15 times under the Sixth Five Year Plan. 32/ In November 1956 it was stated that production would be increased "more than" 10 times and that the proportion of synthetic alcohol would increase from 26 percent of the alcohol produced from inedible materials in 1955 to 70 percent in 1960. 33/ On the basis of the estimated production of alcohol from wood in 1955 and the planned increase of 130 percent in the amount of alcohol produced from this source under the Sixth Five Year Plan, 34/ the goal for the production of synthetic alcohol appears to be 225 million gallons, or 15 times the estimate of 15 million gallons produced in 1955. Alternatively, a plan for the production of alcohol from wood in 1960, given in terms of the grain and potatoes replaced, 35/ indicates a goal for the production of 182 million gallons of synthetic alcohol in 1960. It appears reasonable to assume that the original goal referred to in the draft directives was subsequently revised upward, probably to a level of about 200 million gallons.

4. Information on Plants.

a. Sumgait.

The plant at Sumgait is known to have been in operation by 1952 because a recent article compared costs of production in 1956 with those in 1952. 36/ On the basis of an article published in November 1956 which stated that the process of direct synthesis still had not been mastered in the USSR, it can be assumed that the process employing ethyl

* See Table 5, p. 12, above.

sulfate is used at Sumgait. 37/ An article published in December 1955 indicated that the operation of the plant at full capacity would produce as much alcohol as could be produced from 15 million poods (245,700 tons) of grain. 38/ On the basis of 30 decaliters (79.3 gallons) of alcohol per ton of grain, this figure would mean a capacity of 19 million gallons. During the first 10 months of 1956, the plant reportedly produced 11,000 tons, or 3.69 million gallons, more alcohol than during the corresponding period of 1955. 39/ Inasmuch as production in 1955 is estimated at 15 million gallons,* production in 1956 is estimated at about 19 million gallons. Because production in 1955 reportedly was twice that in 1954, production in 1954 is estimated at 8 million gallons. 40/ The capacity of the plant reportedly will be expanded 30 percent by the end of 1957, 41/ or to about 25 million gallons.

In addition, the construction of a second synthetic alcohol plant in the Sumgait area is planned. In a speech made at the meeting of the Supreme Soviet in February 1957 a deputy from Azerbaydzhan SSR stated that plans drawn up at the republic level call for the construction of a plant which would ultimately save 50 million poods (819,000 tons) of grain, the equivalent of 65 million gallons of alcohol. 42/ He noted, however, that this plant was not included in the Plan for construction in Azerbaydzhan in 1957. The figure of 65 million gallons, added to the capacity of the plant now in operation at Sumgait, which is estimated at 25 million gallons, indicates that by 1960 production in the Sumgait area will reach 90 million gallons.

Another report states that provision has been made for the production of up to 250,000 tons, or 84 million gallons, in the Sumgait area by 1960. 43/ Planned production in the Sumgait area, therefore, is apparently 84 million to 90 million gallons by 1960.

The second plant will obtain its ethylene from mazut, a heavy petroleum fraction, rather than from refinery gases. A recent article indicates that the reason for turning to this source may be that available quantities of ethylene from refinery gases will be insufficient to satisfy future requirements. 44/

b. Saratov.

The plant at Saratov is scheduled to begin operation in 1957, and the process of direct hydration will be used. On the basis of

* See II, A, p. 3, above.

the statement that 15 million poods (245,700 tons) of grain will be saved annually, 45/ the capacity of the plant, like that of the plant at Sumgait, is estimated at 19 million gallons.

c. Ufa.

In October 1956 the construction of a synthetic alcohol plant at Ufa to produce alcohol by direct hydration was reported completed. 46/ This plant will reportedly save 14 million poods (229,300 tons) of grain, 47/ so it evidently has a capacity of 18 million gallons, or about the same as the plants at Sumgait and Saratov.

d. Groznyy.

The alcohol section of the plant at Groznyy has been under construction since at least 1953 48/ and should be in operation in 1957 or 1958. Reportedly the annual saving in grain eventually may be as high as 40 million poods (655,200 tons), which is the equivalent of about 52 million gallons of alcohol. This figure would be the maximum for the production of alcohol, however, because the plant also produces acetone. From this figure and from a statement indicating the feasibility of constructing alcohol plants in the USSR with a capacity of "6, 9, 12, and over, million decaliters of alcohol per year" (16, 24, and 32 million gallons), 49/ it is estimated that the production of alcohol at this plant will amount to 32 million to 40 million gallons.

e. Novo Kuybyshevsk.

The equipment of the synthetic alcohol plant at Novo Kuybyshevsk reportedly was being installed in January 1957, and it was stated that the plant would be in operation "soon." 50/ It is assumed that the capacity will be 20 million to 40 million gallons.

f. Orsk.

The construction of a synthetic alcohol plant at Orsk was completed in 1956. 51/ It is assumed that the capacity will be 20 million to 40 million gallons.

g. Omsk.

The construction of the synthetic alcohol plant at Omsk reportedly was begun in 1956. The plant is scheduled to be in operation by the end of 1960. 52/

h. Lisichansk.

The construction of a synthetic alcohol section of the chemical combine at Lisichansk reportedly was begun in 1956. 53/

i. Ryazan.

A section for the production of synthetic alcohol is included in the petroleum refinery under construction at Ryazan. 54/ The refinery will probably be in operation by 1958.

j. Miscellaneous.

Plans call for the eventual production of synthetic alcohol in Kazakh SSR, but no plants are scheduled to be in operation before 1961. 55/

k. Summary.

The limited information available on individual plants suggests that the production planned for 1960 is 193 million to 247 million gallons (Sumgait, 84 million to 90 million; Saratov, 19 million; Ufa, 18 million; Groznyy, 32 million to 40 million; Novo Kuybyshevsk, 20 million to 40 million; and Orsk, 20 million to 40 million). This estimate agrees reasonably well with the estimates of 182 million and 225 million gallons derived from data on the industry as a whole.*

* See 3, p. 16, above.

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